NETWORK MODELS OF CRYSTALS

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NETWORK MODELS OF CRYSTALS

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The subject matter of the research on this contract has been two-fold: (1) network models for electrons in solids (2) stochastic models of transport amorphous materials.

An important property of the network model is that it is possible to find exact wave functions for various kinds of lattices and materials by this model. The effects of defects, surfaces, and absorbed atoms can be incorporated into the model. The paper best summarizing this part of the program is that by C. H. Wu and E. W. Montroll entitled "A Network Model of Electronic States of Thin Films, Solid Interfaces." This paper will appear shortly in the Journal of Non-Metals.

A summary of the work on amorphous materials is in a paper of H. Scher and E. W. Montroll which is being submitted for publication to Physical Review. The full context of the results of the program are to be found in the publications listed below.

With the exception of certain investigations on exciton transport in photo-synthetic units, the summary of the program is given in the two special manuscripts mentioned above.

The new direction of our continuing program will emphasize energy pickup through photons by photosynthetic units and its transfer into useful chemical energy. Through the understanding of natural photosynthetic units we hope to be able to develop corresponding synthetic units which might be used to manufacture directly from solar radiation, chemicals, other than sugar, which are energy rich. While our present contract terminates, we are developing the latter topic seriously.

Publications Supported by the Contract

(N00014-71-C-0308)

1971

A. Isihara, E. W. Montroll
A Note on the Ground State Energy of an Assembly of Interacting Electrons
Proc. Nat. Acad. Sci. USA 68, 311 (1971)

1972

G. Emch, J. C. Wolfe
A Model for Dissipative Behavior in Non Linear Quantum Optics
J. Math. Phys. 13, 1236 (1972)

V. M. Kenkre
Explanation of an Observation in the Size Quantization Effect
Phys. Lett. 41A, 343 (1972)

F. T. Lee, E. W. Montroll
Quantum Theory on a Network. III. A Monatomic Lattice with Defects
J. Nonmetals 1, 35 (1972)

1973

V. M. Kenkre
Equations for the Theory of Response and Transport in Statistical Mechanics
Phys. Rev. A 7, 772 (1973)

V. M. Kenkre, E. W. Montroll, M. F. Shlesinger
Generalized Master Equations for Continuous-Time Random Walks
J. Statistical Phys. 9, 45 (1973)

F. T. Lee, E. W. Montroll, Lee-Po Yu
Two-Component Ising Chain with Nearest-neighbor Interaction
J. Statistical Physics 8, 309 (1973)

E. W. Montroll, H. Scher
Random Walks on Lattices. IV. Continuous Time Walks and Influence of Absorbing Boundaries
J. Statistical Phys. 9, 101 (1973)

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V. M. Kenkre
Coupled Wave-like and Diffusive Motion of Excitons
Phys. Lett. 47A, 119 (1974)

V. M. Kenkre, R. S. Knox
Generalized-Master-Equation Theory of Excitation Transfer
Phys. Rev. B 9, 5279 (1974)

IN PRESS

C.-H. Wu, E. W. Montroll
A Network Model of Flectronic States of Thin Films, Solid Interfaces, and Planar Defects
to be published (1974)